# RETROFIT KIT FOR A TRAINING DEVICE AND TRAINING DEVICE

## Field of the Invention

The invention generally relates to a training device and a retrofit kit for a training device. The training device is adapted to be operated by a training force applied by an individual who is training and by means of a training weight. The training weight can be formed by one or more combinable single weights to provide a counterforce to oppose the training force. The retrofit kit can comprise an oscillation generating device which is adapted to be fitted to the training device. The oscillation generating device can produce an oscillation which influences and modulates the counterforce.

## BACKGROUND OF THE INVENTION

Training devices are often used to train certain muscles or groups of muscles. The user's muscles apply a training force against the resistance of the counterforce provided by the training device.

Weight training can be carried out with unrestricted movability of the body part, such as with free weight training, for example, with dumbbells. Free weight training, however, requires a certain amount of training experience and a good feeling for movement, because the movement of the body part must be performed so exactly that essentially only the muscles to be trained are used to overcome the counterforce. If the movement is performed incorrectly or inaccurately, then the risk of injury increases on one hand and the efficiency of the dumbbell training is reduced on the other.

In order that individuals who have little sports experience can perform weight training, training devices that have a mechanically more complex construction are used instead of free weights. The objective of these training devices is to guide the training movement exactly and to facilitate a simple and precise setting of the counterforce, so that a predetermined selection of muscle groups is trained exclusively.

The design of these training devices differs on one hand in the type of muscle groups involved. For example, for training of the extensor muscles, pressure plates or handles are provided as actuating elements which are pushed away from the user's body against the counterforce. For training of the flexor muscles, actuating elements are provided which must be pulled towards the body against the counterforce.

The configuration of the actuating element in turn depends on the body part to be trained. For example, handles may be provided for training the arm and shoulder muscles. In contrast, for training the trunk and leg muscles, upholstered pressure elements, plates, or loops are usually provided.

Conventional training devices differ depending on the way in which the counterforce is produced. The training force can be produced by a force generating device mechanically, kinematicaliy, electromagnetically or pneumatically. Most common is the generation of the counterforce in a mechanical way by a training weight. A kinematic training force can be produced by a frictional or motion resistance, for example, by a rotor turning in a liquid or by an eddy-current brake. Electromagnetic counterforces can be generated by the magnetic attractive force or by a generator. Pneumatic generation of the counterforce by pressure cylinders is also possible. All these devices permit an exact setting of the counterforce, for example, by changing the training weight or by changing the pressure in a pressure cylinder.

Some training devices have complex controls for limiting the speed with which the training movement can be performed in that they automatically increase the counterforce when the speed of movement is above a predetermined limiting speed and they automatically reduce the counterforce when the speed of movement is below a predetermined limit. Other devices automatically change the magnitude of the counterforce with consecutive executions of the training movement so that prespecifiable load profiles can be followed.

Consequently, in DE 195 32 254 C1 and US 850,938 dumbbells are in each case described with which an oscillation produced by unbalanced driven masses in the dumbbell is transferred to the muscles of the body part to be trained.

In DE 200 10 140 U1, a supplementary device for a training device is described. The training device oscillates its actuating handles or surfaces. In this way, the muscles of the individual working on the actuating handles or surfaces are subjected to load variations.

Finally, US 4,989,861 discloses a training device which produces a series of pulsing forces in the direction of a resistance force generated by the training device. In this manner the muscles of the individual who is training are stretched with the pulsing force. The training device comprises a pulse-force generation unit which produces the pulsing force and transfers the force via a pulling means, such as for example a chain, in the direction of the resistance force.

## BRIEF SUMMARY OF THE INVENTION

Some non-limiting embodiments of the invention have the purpose of achieving a detectable training effect as fast as possible with the lowest possible risk of injury and the most simply to perform training movement.

Also the object of some embodiments of the invention is to further improve known training devices such that more effective training is possible with an unchanged simple movement.

According to some embodiments of the invention, a retrofit kit and training device (*e.g.*, free weights or machines) have an oscillation generating device formed as a single weight.

The superposition of the counterforce with the oscillations leads to an increase in the training effect, because the dynamic or static weight training with an essentially constant counterforce is linked to reflex training. The variations of the counterforce may lead to a more rapid fatigue of the muscles and to an increased training stimulation.

Some embodiments of the invention are in the form of a retrofit kit. The retrofit kit can be incorporated into a conventional weight machine such that their

training effect is improved. Apart from the training devices with guided movement, dumbbells can also be equipped with the retrofit kit.

Of course, the oscillation generating device can also be built into new training devices right from the start during production.

Some embodiments of the invention relate to training devices with which the counterforce is generated by a movable training weight. The training weight comprises one or more individual weights, which can be combined to form one total weight (*e.g.*, a stack of weights). The individual weights can be disc or plate-shaped.

In order not to interfere with the operation of the training device, the size of the retrofit kit is matched to the available space in the training device. A particularly low impairment of the operation of the training device arises, because the oscillation generating device is designed in the form of a single weight. Moreover, the oscillation generating device can, for example, be accommodated in a housing, the dimensions of which correspond to a single weight or a stack of single weights. The oscillation generating device is simply used as a single weight.

The retrofit kit and the training device can be further improved by various, mutually independent designs as briefly explained in the following.

The oscillation generating device can be adapted to be attached to the training weight so that it also moves with the movement of the training weights. With training weights shaped as discs or plates the oscillation generating device can be designed to be placed on the training weight. Both measures facilitate a simple conversion of the training device and an effective transfer of the oscillations to the training device.

In order to provide the same counterforces with or without the oscillation generating device, it is advantageous if the sections of the oscillation generating device moving under the action of the training force have a weight which essentially corresponds to a single weight or an integer multiple of a single weight. The counterforce can be provided by a number of single weights, because the oscillation generating device can be used as a single weight. Typical weights for the oscillation

generating devices used as single weights in training devices are, for example, 0.5 kg, 1 kg, 2 kg, 5 kg, 10 kg, 20 kg and 50 kg.

To generate the oscillation modulating of the counterforce, the oscillation device can comprise a periodically moving oscillating mass and / or a vibration motor. In this embodiment, the oscillation generating device can not only be used in training devices in training weights, but rather also in training devices with a counterforce produced in a different way. The oscillation generating device only needs to be fitted to an element moved by the training force. Due to the inertia of the moving oscillating mass, the oscillation generating device produces an oscillating force that is superimposed on the counterforce.

The training effect can be increased in a further embodiment if the amplitude and frequency of the oscillation modulating or forces superimposed on the counterforce are matched to the training force and the training movement. To achieve the optimum adaptation of the oscillations to the training conditions, the retrofit kit or the training device can in a further advantageous embodiment comprise a control device which allows the oscillation amplitude and / or oscillation frequency generated by the oscillation device to be changed. For example, when training with a higher counterforce and a slower movement speed, a slow oscillation of high amplitude can be provided. When training with a low counterforce, a high frequency oscillation of low amplitude can be superposed to the counterforce.

Hereby, the control device can be arranged in a housing remote from the oscillation generating device, so that a comfortable remote control, for example from the training site, is possible.

In some embodiments, which irrespective of the previously discussed embodiments can represent an independent invention, the oscillation generating device is configured in the form of a dumbbell or in the form of a dumbbell weight.

Here, the dumbbell or the dumbbell weight (*e.g.*, a dumbbell disc) can be provided with contacts and a rechargeable energy supply device, which is automatically rechargeable via the contacts when the dumbbell is placed in a receptacle. The

dumbbell or the dumbbell weight can be brought to a standard weight, such as, for example, 5 kg by additional supplementary weights. In some embodiments, the vibration motor can be arranged as centrally as possible in the handle of the dumbbell disc and can drive appropriate flywheel masses at its ends. This produces an ergonomically balanced dumbbell. Alternatively, vibrating motors with appropriate flywheel masses can be spaced generally equal distances from the center of the dumbbell. In this case, the dumbbell is also balanced.

In the following, various embodiments are explained as examples with reference to the drawings. As explained in the above description of the individual advantages of the various embodiments, the various features can be combined with one another as required and individual features can also be omitted in the individual embodiments.

## BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

Figure 1 is a schematic perspective view of a training device with a first embodiment of the oscillation generating device according to the invention.

Figure 2 is a schematic representation of the time trace of the force in a training device with an oscillation generating device according to the invention.

Figure 3 is a schematic perspective view of a second embodiment of an oscillation generating device.

Figure 4 is a schematic perspective view of another embodiment of a training device according to the invention.

Figure 5 is a schematic perspective view of another embodiment of a training device in the form of a dumbbell according to the invention.

Figure 6 is a schematic perspective view of another embodiment of a training device in the form of a dumbbell weight according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a schematic view of an embodiment of a training device 1, which comprises a force generating device 2 and an oscillation generating device 3. The force generating device 2 and the oscillation generating device 3 are in the form of a retrospectively fitted retrofit kit. The aftermarket kit can be conveniently incorporated into the training device 1.

The training device 1 also includes an actuating element 4 via which a user, not illustrated in Figure 1, applies a training force T to the training device 1. The actuating element 4 can, as shown in Figure 1, be configured in the form of an interchangeable handle bar, so that by pulling on the handle bar with the training force T the muscles in the arm/shoulder region are trained. Other embodiments of the training device 1 can have the actuating element 4 in the form of pressure elements, which can be pressed away from the user by applying the training force T.

The training force T is transferred from the actuating element 4 via a force transfer element 5 to the force producing means 2. The force transfer element 5 (illustrated as a cable in Figure 1) canengage a traction means guided, for example, by pulleys 6.

When the training device 1 is operated, the force producing means 2 produces a counterforce G acting against the training force T, thereby providing resistance to movement of the actuating element 4 which leads to the training effect.

As shown in Figure 1, the force producing means 2 for generating the counterforce G can comprise a training weight 7, which is connected to the force transfer element 5 and is moved by pulling on the actuating element 4. With this embodiment, the level of the counterforce G depends on the total weight of the moving mass of the training weight 7.

To train with different counterforces G, the at least one training weight 7 can comprise a plurality of single weights 8 which can be combined to form a training weight of a specified mass. The single weights 8 preferably have standardized masses,

such as, for example, 0.5 kg, 1 kg, 2 kg, 5 kg or 10 kg. The single weights can be accommodated interchangeably in the training device.

The single weights 8 may be disc or plate-shaped and are arranged in the form of a stack. The level of the counterforce G is thus determined in a simple manner according to the weight of the stack of single weights moved by the training force T.

As can also be seen in Figure 1, the training weight 7 of the training device 1 is guided by rod-shaped guide elements 9 so that the risk of injury due to uncontrolled movements of the training weight is minimized.

Due to the oscillation generating device 3 fitted to the training device 1, the training effect of the training device 1 is increased. The oscillation generating device 3 produces an oscillation with which the counterforce G is superimposed and modulated. The modulation of the counterforce G due to the oscillation is schematically illustrated in Figure 2.

In Figure 2 the trace of the counterforce G against time t is plotted with the oscillation generating device 3 switched on. As can be seen, the momentary value G of the counterforce is composed of a temporal mean $\underline{\underline{G}}$ and a momentary oscillatory component G′, as represented by the equation $G = \underline{\underline{G}} + G'$. The temporal mean $\underline{\underline{G}}$ corresponds to the force produced by the force generating device 2 and the oscillatory component G′ can be attributed to the oscillation generating device 3.

As can be seen in Figure 2, the oscillatory component G′ can exhibit a periodic function (*e.g.*, a sinusoidal function) with a period T or a frequency f = 1/T and an amplitude $G_A$, so that $G' = G_A \sin(2\pi ft)$ applies.

The counterforce, which may include the oscillations, is transferred via the force transfer element 5 to the actuating element 4 so that the user is also subjected to the dynamic variations of the counterforce. If the user pulls with a constant training force T, then the difference T-G changes with the varying force G′. The force difference leads to a varying movement superimposed on the training movement, causing the additional training stimulation.

The frequency f and the amplitude G′ of the varying force produced by the oscillation generating device 3 can be set independently of one another via a control device 10 and optimally matched to the training force T.

Thus, when training with a high counterforce G and a rather slow execution of the training movement, a low frequency f and a high amplitude $G_A$ may be set.

The control device 10 is arranged in a separate housing and connected via a signal lead 10a to the oscillation generating device 3. The amplitude and / or frequency can be conveniently changed at a position remote with respect to the training weight.

Figure 3 shows another embodiment of an oscillation generating device 3 according to some embodiments of the invention. The oscillation generating device 3 of Figure 3 is configured in the form of a single weight 8. The weight of the sections of the oscillation generating device 3 that are moved under the action of the training force may correspond to one single weight 8 or an integer multiple of the single weights 8. For example, each of the single weights 8 can have a mass of 0.5 kg and the oscillation generating device 3 can have a mass of 1 kg. In this way, the oscillation generating device 3 and one or more of the single weights can be used to provide counterforces familiar to the user.

If the oscillation generating device 3 is a single weight in the stack of weights, the generating device 3 can be positioned to provide the lowest counterforce. For example, the oscillation generating device 3 is the topmost weight in the stack of single weights, as shown in Figure 3.

The oscillation generating device 3 of Figure 3 is arranged in the form of a single weight which can be connected on one side to the force transfer element 5, so that the force flux of the training force T and the counterforce G are directed through the oscillation generating device.

Also, the oscillation generating device 3 can be provided with a rod 11 which extends through the stack of single weights 8. Openings 12 of the rod 11 can be

used to select the number of weights lifted during training. A stack of single weights 8 can be positioned on the rod 11 such that a pin 13 can be inserted through an opening 14 in the weight and one of the openings 12 of the rod 11. By inserting the pin 13 in the opening 14 and the opening 12 located behind it, the respective single weight 8 is coupled to the rod 11 and carries the stack of single weights located above it.

The oscillation G′ superimposed on the counterforce G can be produced in the oscillation generating device 3, for example, by a moving oscillating mass 15. Due to a to and fro movement of the oscillating mass 15, such as a pendulum movement or an eccentric rotary movement, a time-varying force is produced in the direction of the training force T. In the embodiment of Figure 3, the oscillating force is produced by an eccentric unbalanced mass 15 which is driven by an electric rotary motor 16 and which has its center of gravity offset from the axis of rotation 17 of the rotary motor.

The frequency of the varying force G′ is defined by the speed of the rotary motor 14. The amplitude of the weight force G′ can be changed by the eccentricity of the unbalanced weight 15, *i.e.* by a change in the distance of the center of gravity of the eccentric mass 15 to the axis of rotation 17. The larger the eccentricity of the unbalanced weight, the larger the amplitude $G_A$ of the oscillations produced by the oscillation generating device 3. The power supply for the rotary motor 14 can be provided via the control lead 10a and the control device 10.

The embodiment as it is described in Figures 1 and 3 can be used not only with a training device with training weights, but rather also with training devices which produce the counterforce in a different way. The oscillating force produced by the oscillation device actually modulates the counterforce independently of how the counterforce is produced. For example, the oscillation generating device 3 can introduce the oscillations directly on the actuating element 4, as is illustrated as an example in Figure 4 with a training device formed as a leg press with a pneumatic pressure cylinder as the force generating device 2. To achieve an introduction of the oscillations into the training device as free of losses as possible and with the most direct

superimposition of the counterforce G as possible, it is advantageous if the oscillation generating device is fitted directly to the parts moved by the training force or directly on the parts bearing the training force.

In Figure 5, an additional embodiment of the training device in the form of a dumbbell 1 is illustrated. The use of the oscillation generating device with dumbbells can represent an invention of its own even though the oscillation generating device can be used with complex, movement-guided training devices (*e.g.*, the devices illustrated in Figures 1 to 4).

As illustrated in Figure 5, the dumbbell 1 includes an oscillation generating device 3. The dumbbell 1 comprises a grip section 18 and two fixed or removable weight sections 19 at opposing ends of the grip section 18. The diameters of the weight sections 19 are larger than the diameter of the grip section 18. The masses of the weight sections 19 can be selected so that the dumbbell 1 is well balanced.

The dumbbell 1 is provided with a vibrating motor 14, which drives two unbalanced weights 16 in corresponding weight sections 19 about the axis of rotation 17. The axis of rotation 17 extends generally in the direction of the grip section 18. Furthermore, energy supply devices (for example, one or more non-rechargeable or rechargeable batteries) can be in the weight sections 19 and configured to power the vibrating motor 14. The energy supply devices can be accessible via a removable housing section 20 on the dumbbell 1. In order to, for example, charge rechargeable batteries for the operation of the vibrating motor 14 without having to dismantle the dumbbell, contacts 21 can also be provided via which the dumbbell is automatically charged in an appropriate dumbbell receptacle.

For the weight of the dumbbell 1 to correspond to a standard weight, additional weights 22 can be provided in the weight sections 19 of the dumbbell 1, which can be complemented with the vibrating motor 14, dumbbell housing 1, energy supply devices and the flywheel masses 16 for the standard weight.

To fit the dumbbell easily into the hand, the unbalanced masses 16, which are arranged on a continuous drive shaft 23 of the vibrating motor, are equally large. Of

course two vibration motors which drive the unbalanced masses 16 independently of one another can also be provided instead of a single vibration motor 14.

In Figure 6, a further embodiment of a single weight formed as an oscillation generating device 3 is shown. The single weight of the embodiment of Figure 6 is formed as a dumbbell disc in which a vibrating motor 14 is integrated, which moves the flywheel masses 16 to and fro in the direction of the arrow 25 via a crank mechanism 24. Moreover, the flywheel mass 16 is moved in guides 26. With the embodiment of Figure 6 instead of a crank mechanism an eccentric ring can be provided which runs around the dumbbell rod receptacle 27 of the dumbbell disc with an unbalanced weight.

During training, the single weight of Figure 6 with the opening 27 is simply pushed onto the dumbbell rod, preferably in pairs, on both ends of the dumbbell rod.